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Research Report 1577

Concept for a Common Performance Measurement System for Unit Training at the National Training Center (NTC) and With Simulation Networking (SIMNET)

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James W. Kerins, Nancy K. Atwood,
and James T. Root
BDM International, Inc.

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September 1990

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U.S. ARMY RESEARCH INSTITUTE FOR THE BEHAVIORAL AND SOCIAL SCIENCES

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Research accomplished under contract
for the Department of the Army

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This research was focused on the first objective and presents a concept for the design of a common performance measurement system for unit training at the National Training Center (NTC) and Simulation Networking (SIMNET). Two platoon missions (defense and hasty attack) were used as the vehicle for presenting the concept. The measurement model established in previous ARI research on unit performance measurement and used to guide the present efforts is a three-part model that recognizes the roles of process, outcome, and expert judgment in assessing unit performance. The model provides "bottom line" outcome measure of mission accomplishment derived from the accepted military analysis factors of mission, enemy forces, friendly troops, terrain, and time (METT-T). In addition to METT-T factors, AMTP-based mission critical tasks have been identified that provide a benchmark for measuring the degree of unit conformity to established tactical doctrine. The concept for a common performance measurement system (across both NTC and SIMNET training) described herein examines the applicability of the NTC-based model to the SIMNET environment and identifies the boundaries of overlap between the two training settings.

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METT-T	Expert judgment
Critical tasks	Observation
Measure of performance (MOPs)	Plan view display
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Research Report 1574

Concept for a Common Performance Measurement System for Unit Training at the National Training Center (NTC) and With Simulation Networking (SIMNET)

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FOREWORD

The National Training Center (NTC) is recognized as the closest to a real combat environment currently available to the Army, but the expense of training at the NTC precludes frequent rotations by any single unit. Other means must be found that provide greater cost efficiencies and effectiveness for unit training at home station. Simulation Networking (SIMNET) may provide such an alternative.

Strategies are needed for integrating SIMNET training into the Army training system. This report addresses a needed element in the development of such strategies. It presents a concept for the design of a common performance measurement system for unit training in the NTC and SIMNET environments. This concept is being applied in an ARI research effort to develop SIMNET training methods and strategies.

EDGAR M. JOHNSON
Technical Director

CONCEPT FOR A COMMON PERFORMANCE MEASUREMENT SYSTEM FOR UNIT TRAINING AT THE NATIONAL TRAINING CENTER (NTC) AND WITH SIMULATION NETWORKING (SIMNET)

EXECUTIVE SUMMARY

Requirement:

The research described in this paper was part of a larger effort sponsored by the U.S. Army Research Institute for the Behavioral and Social Sciences (ARI) with participation by the Combined Arms Training Activity (CATA). The larger effort had three primary objectives: (1) to design a performance measurement concept for SIMNET technology based on previous ARI/CATA sponsored research focused on improving the Army Training and Evaluation Program (ARTEP) using the NTC as the developmental vehicle; (2) to design and evaluate a training management system for SIMNET technology (e.g., identification of prerequisite skills, design of training scenarios, strategies for training feedback); and (3) to design training strategies for incorporating SIMNET training into the Army training system.

This research focused on the first objective and presents a concept for the design of a common performance measurement system for unit training at the National Training Center (NTC) and Simulation Networking (SIMNET). Two platoon missions (defense and hasty attack) were used as the vehicle for presenting the concept.

Procedure:

The measurement model established in previous ARI research on unit performance measurement and used to guide the present effort is a three-part model that recognizes the roles of process, outcome, and expert judgment in assessing unit performance. The model provides a "bottom line" outcome measure of mission, enemy forces, friendly troops, terrain, and time (METT-T). In addition to METT-T factors, ARTEP Mission-Training-Plan-(MTP) based mission-critical tasks have been identified that provide a benchmark for measuring the degree of unit conformity to established tactical doctrine.

The concept for a common performance measurement system (across both NTC and SIMNET training) described herein examines the applicability of the NTC-based model to the SIMNET environment and identifies the boundaries of overlap between the two training settings.

Findings:

Three types of measures of performance (MOPs) were generated for all NTC-based critical tasks identified as supportable or potentially supportable in

SIMNET based on the specific requirements of each critical task: (1) automated MOPs (those that can be collected from the SIMNET data stream; (2) observable MOPs (i.e., those that can be gathered by direct observation of task performance, indirect observation using the plan view display, and/or expert judgment based on syntheses of observable and automated MOPs; and (3) "other" MOPs (those that would require a modification either in the SIMNET facility--such as the acquisition of a multi-channel recorder for radio nets--or in the SIMNET simulation software).

Utilization of Findings:

The measurement concept, to include METT-T factors, identified critical tasks. MOPs now must be further elaborated through a systematic design process to build a fully functional feedback system. This process includes the design of data collection tools (including screen displays for automated data collection), data analysis plans, structured approaches for data interpretation, and strategies for feedback presentation. These processes were addressed in the other requirements of the larger research effort.

CONCEPT FOR A COMMON PERFORMANCE MEASUREMENT SYSTEM FOR UNIT TRAINING AT THE NATIONAL TRAINING CENTER (NTC) AND WITH SIMULATION NETWORKING (SIMNET)

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CONCEPT FOR A COMMON PERFORMANCE MEASUREMENT SYSTEM FOR UNIT TRAINING AT THE NATIONAL TRAINING CENTER (NTC) AND WITH SIMULATION NETWORKING (SIMNET)

Purpose

The purpose of this report is to present a concept for the design of a common performance measurement system for unit training at the National Training Center (NTC) and with Simulation Networking (SIMNET). In this report, two platoon missions (Defense, Hasty Attack) are used as the vehicle for presenting the concept. The methodology has been applied to the Platoon and Company echelons for the Defense, Hasty Attack, and Movement to Contact missions. The results of these applications are contained in separate publications (Kerins and Atwood, 1990a,b,c; Kerins, Root, and Atwood 1989a,b c). These missions and echelons were identified based on guidance about frequency and type of training missions anticipated in initial SIMNET usage for unit training.

The research described here is part of a larger project sponsored by the U.S. Army Research Institute (ARI) with participation by the Combined Arms Training Activity (CATA). The project has three primary objectives: 1) to design a performance measurement concept for the SIMNET technology keying off previous ARI/CATA sponsored research on an improved Army Training and Evaluation Program (ARTEP) that has focused on the NTC for development; 2) to design and evaluate a training management system for the SIMNET technology (for example, identification of prerequisite skills, design of training scenarios, strategies for training feedback); and 3) to design training strategies for incorporating SIMNET training into unit training programs (along with other types of training such as UCOFT, ARTBASS, FTXs, CPXs among others).

This research report is the initial project deliverable focused on the first objective of the project. It is organized into five major sections: background, measurement approach, methodology for application to SIMNET, key findings, and next steps.

Background

Simulation Networking (SIMNET) is an innovative simulation that uses computer driven networked training devices to support combined arms training at unit home stations. SIMNET is a project of the Defense Advanced Research Project Agency (DARPA) with Perceptronics as the prime design and development contractor. Currently, SIMNET technology is being used to provide fully interactive low-cost simulators that permit tactical training of heavy units in a simulated combined arms combat environment. These full-crew modules can operate independently or can be networked locally (and eventually over long distances with a long haul network) to form platoons, companies, or battalions.

With the Army decision to field SIMNET at unit home stations and to secure production versions with even greater capabilities (the Close Combat Tactical Trainer or CCTT), the Army training community faces a host of important questions on what the role of SIMNET should be in a unit training program, how SIMNET training should be conducted, and on what basis unit performance should be measured. These are complex questions with important policy and technical considerations.

The Training Research Laboratory of the Army Research Institute is charged with the mission of conducting research on emerging and systemic issues on training the force and providing senior Army leadership with research-based recommendations on Army training. ARI has undertaken this exploratory research effort to examine critical issues emerging on SIMNET training. The performance measurement aspect of SIMNET collective training is a natural extension of previous ARI research on unit performance measurement.

This previous ARI research on unit performance measurement has been conducted at the ARI Field Unit at the Presidio of Monterey with contract support from The BDM Corporation. The current performance measurement extension to SIMNET is being performed by BDM for the ARI Field Unit at Fort Knox under a Perceptronics, Inc. contract with Los Alamos National Laboratory. The research is predicated on the Army's overall training philosophy as laid out in FM 25-100, the Army's capstone training manual. At the heart of this philosophy is the concept of train-evaluate-train.

As shown in Figure 1, training is seen as an iterative process which requires explicit statement of training objectives and requirements, formulation and execution of a training strategy and an evaluation of performance. Thus, performance assessment is a key feature of the training management cycle. A system for measuring performance is required to assess a unit's capability in order to determine training requirements. Such a system is also required to assess the outcomes of training and to determine needs for follow-on training. In essence, a performance assessment system provides the diagnostic feedback that ties the entire training management cycle together and allows leaders to assess the strengths and weaknesses of their unit (i.e., their training status).

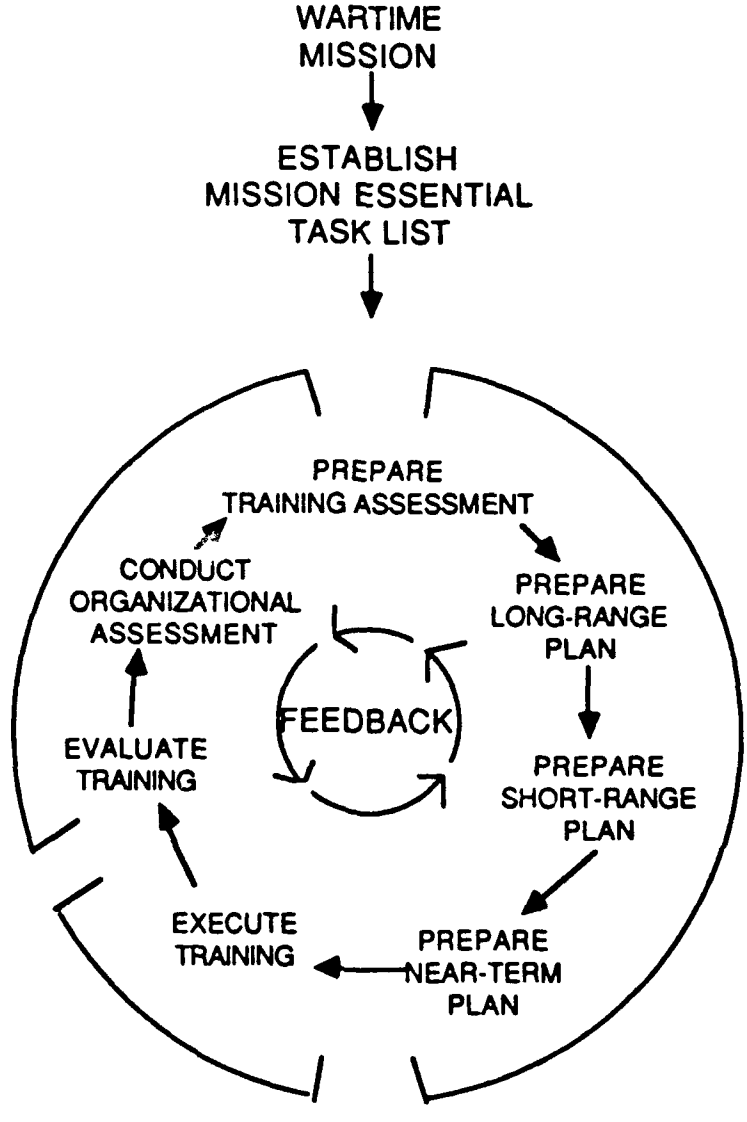


Figure 1. Training management cycle (from FM 25-100).

Tactical doctrine and training literature provide basic guidance for training at home station generally and for advanced collective training at the Army's Combat Training Centers (CTCs). Training guidance literature (Army Training and Evaluation Programs [ARTEPs] and Army Mission Training Plans [AMTPs]) prescribe tasks that allow scoring of unit performance in order to determine how closely performance conforms to doctrine. However, ARTEPs/AMTPs in their current form are impractical to use for assessing unit performance particularly in advanced collective training environments such as the CTCs (see Hiller, 1988). More specifically, the use of evaluation checklists based on the AMTP have considerable practical difficulties when they are implemented as scoring protocols for field exercises.

Some of these difficulties arise from the lack of priority to given performance elements, uncertain relationships to METT-T factors for these elements, and the lack of an organizing structure. Furthermore, they do not take into account the unique capabilities of computer-enhanced training (such as the instrumented battlefield of the NTC or computer- driven simulations such as SIMNET) for assessing unit performance. Finally, they do not include a strategy for assessing overall mission effectiveness. Such objective measures of performance are important benchmarks for gauging the validity of training and doctrine and for identifying lessons learned on systemic improvements in these areas.

ARI has been pursuing a research program to develop methodologies to strengthen the ARTEP/AMTP programs as unit performance measurement tools. The focus of this research has been on the NTC because of its maturity as a training site, the realism of the training experience for units and the central role of the CTC program in providing advanced collective training. Briefly, the NTC at Fort Irwin, California was the first CTC established by the Army and has been operational for over seven years. The NTC provides mission essential combined arms training for armor and mechanized infantry forces. The NTC has several critical features that contribute to a realistic combat simulation: 1) a constrained free-play training environment governed by rules of engagement; 2) a dedicated Opposing Force which uses Soviet tactics and equipment; 3) a battlefield environment which includes electronic warfare and close air support; 4) extensive use of tactical engagement simulation including MILES (Multiple Integrated Laser Engagement Simulation); and 5) a complex instrumentation system for real-time data collection of mission events. Although the NTC does not provide a complete combat simulation due to deficiencies in instrumentation for indirect fire, mobility and countermobility, and air support and air defense, it does stress heavy forces in the use of their organic weapon systems.

SIMNET is a natural counterpart to the NTC because of its orientation on heavy units and its capability to simulate a combined arms battlefield under free play conditions. The following section describes the measurement approach developed in the ARI research based on the NTC. Subsequent sections describe the methodology used to apply the approach to SIMNET and highlight key findings from this application.

Measurement Approach

The measurement model used to guide the ARI research program on unit performance measurement is shown in Figure 2. The three-part model recognizes the roles of process, outcome and expert judgment in assessing unit performance and specifies three forms of measurement.

The mission results portion of the model provides a "bottom line" outcome measure of mission accomplishment (Root and Zimmerman, in preparation). These measures are organized around the accepted military analysis factors of METT-T (mission, enemy forces, friendly troops, terrain and time). Since measures are specific to particular types of missions and time is a scenario-driven constant at the NTC, this portion of the model reduces to the following three

indices which may be treated separately or combined to form a composite index: 1) percentage of friendly forces (major instrumented weapons systems remaining at the end of a combat mission); 2) percentage of enemy forces killed; and 3) terrain control, as measured by the percentage of weapons systems crossing a defensive boundary.

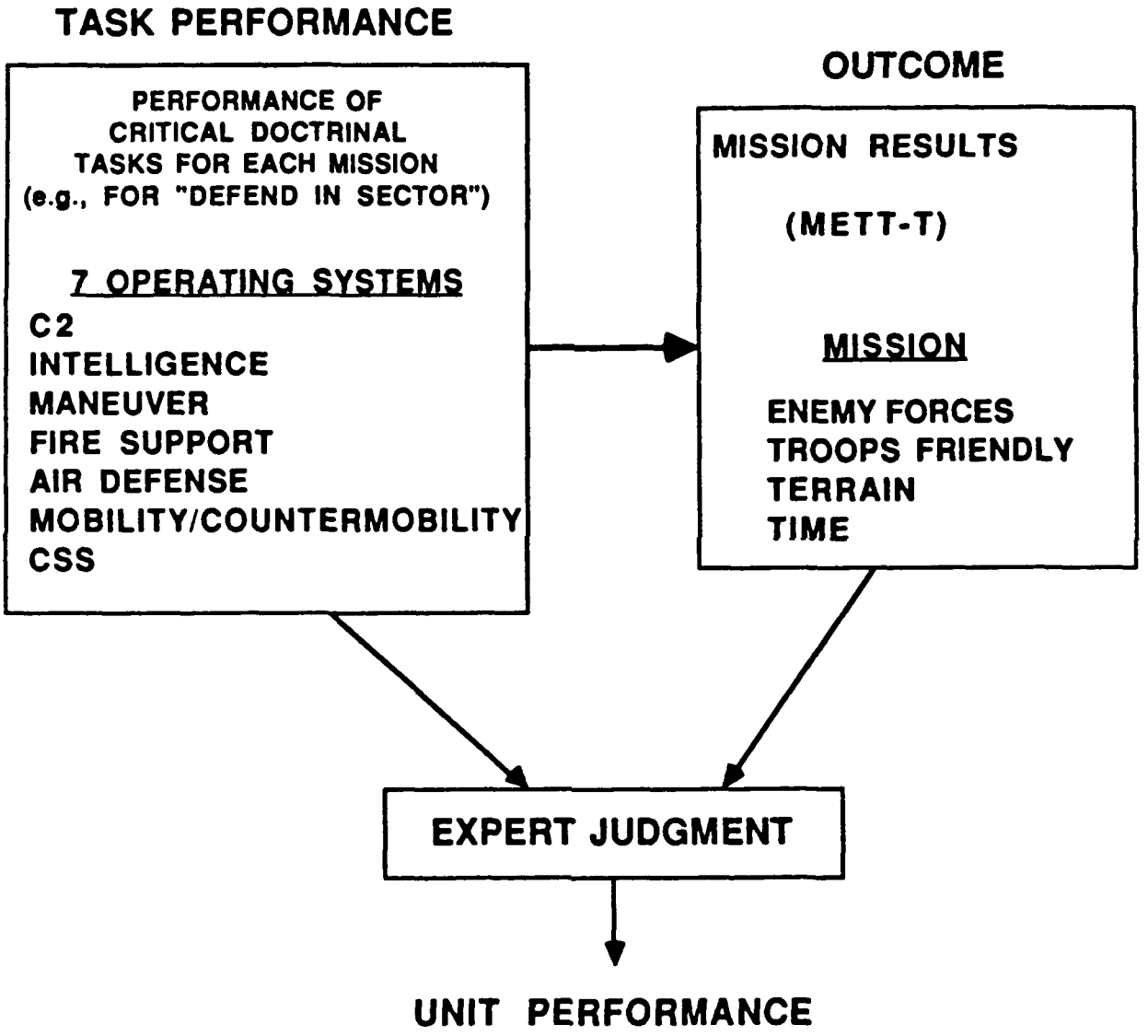


Figure 2. Measurement model.

The critical task performance component of the model provides an immediate process measure of unit behaviors that contribute to mission accomplishment (Lewman, in preparation). Furthermore, because critical tasks are doctrinally based, measures of task performance indicate the degree of unit conformity to tactical doctrine.

The methodology used at ARI-POM to identify critical tasks has several important features. First, it is based on a collective front end analysis which drew on doctrinally identified tasks as a starting point. This analysis, performed by BDM for ARI-POM, was conducted on all relevant doctrinal manuals at Platoon, Company, and Battalion levels available in the Spring of 1986 through the Spring of 1987. The sources have been identified in Lewman (In preparation). These tasks were carefully analyzed and considered for their criticality by military subject matter experts at the NTC, the Combined Arms Training Activity, the Infantry and Armor Schools, and selected FORSCOM units. Thus, task lists represent a culled set of critical tasks substantially reduced in size from a standard ARTEP/AMTP set that has survived considerable scrutiny. (See Figure 3.)

BATTALION

	INT	MAN	FSA	ADA	ENG	CSS	NBC	C&C	TOTAL
Planning	12	21	7	7	8	5	1	23	84
Preparation	9	9	6	7	6	10	1	13	61
Execution	7	19	5	2	5	6	2	8	54
Total	28	49	18	16	19	21	4	44	199

COMPANY/TEAM

	INT	MAN	FSA	ADA	ENG	CSS	NBC	C&C	TOTAL
Planning	11	26	10	2	4	6	2	25	86
Preparation	5	8	9	2	4	6	1	10	45
Execution	4	19	2	2	4	6	1	11	46
Total	20	53	21	2	12	6	4	46	177

PLATOON

	INT	MAN	FSA	ADA	ENG	CSS	NBC	C&C	TOTAL
Planning	6	21	5	2	4	2	1	21	61
Preparation	3	11	3	1	5	3	1	10	37
Execution	2	21	2	2	5	4	1	10	47
Total	11	53	10	5	14	9	3	41	145

Figure 3. Number of critical NTC tasks.

Second, the tasks have been organized into a battle flow framework which identifies battle phases and segments with a specific purpose and observable outcome as shown in Figure 4. Furthermore, critical tasks have been linked within this organizing structure to show sequential and functional linkages. (See Figure 5.) Taken together, the battle flow framework and the task linkage structures provide organizing structures for data collection (either manual or computer-aided with some type of Electronic Clipboard) as well as an analytic framework for examining patterns of task performance.

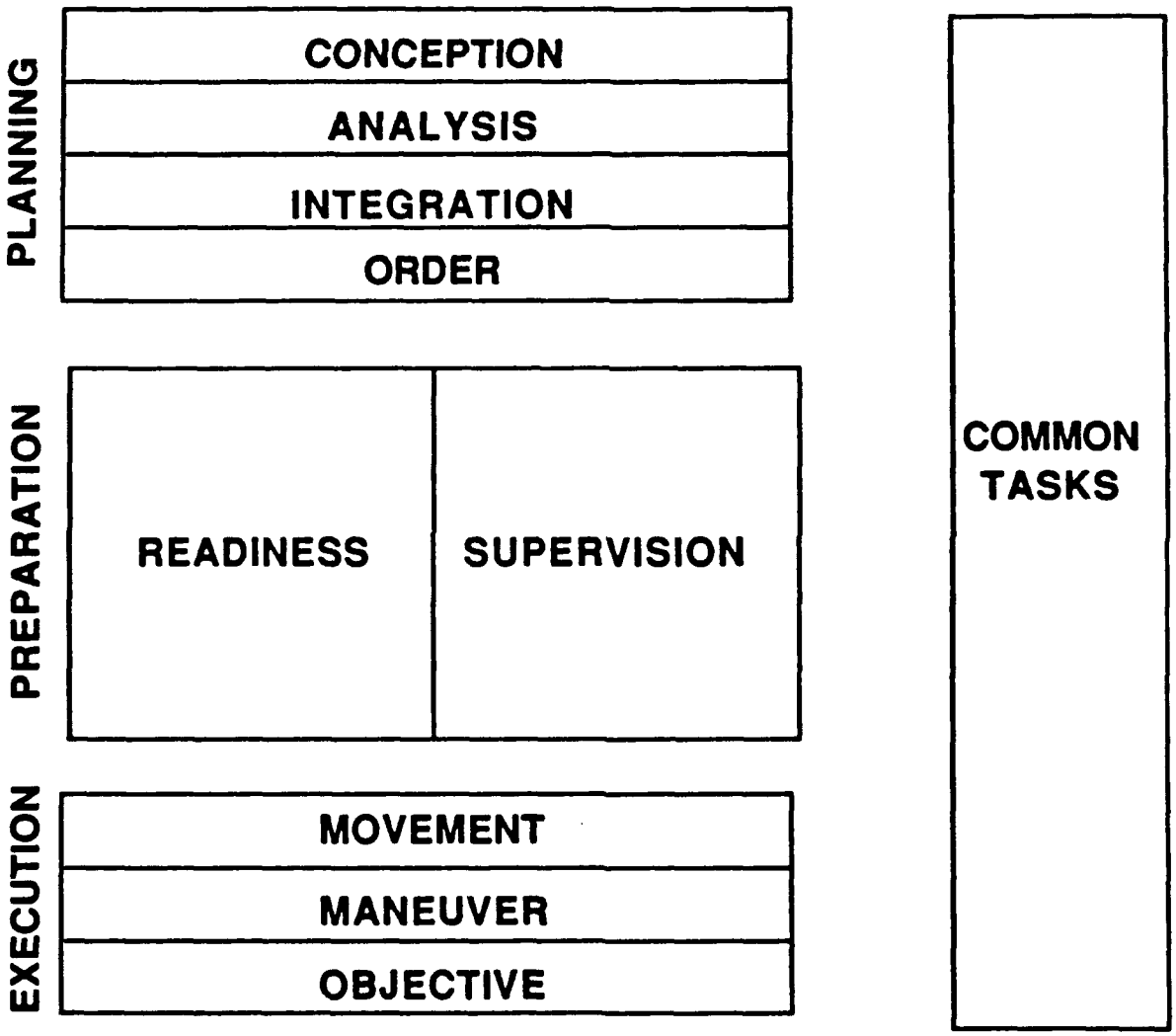
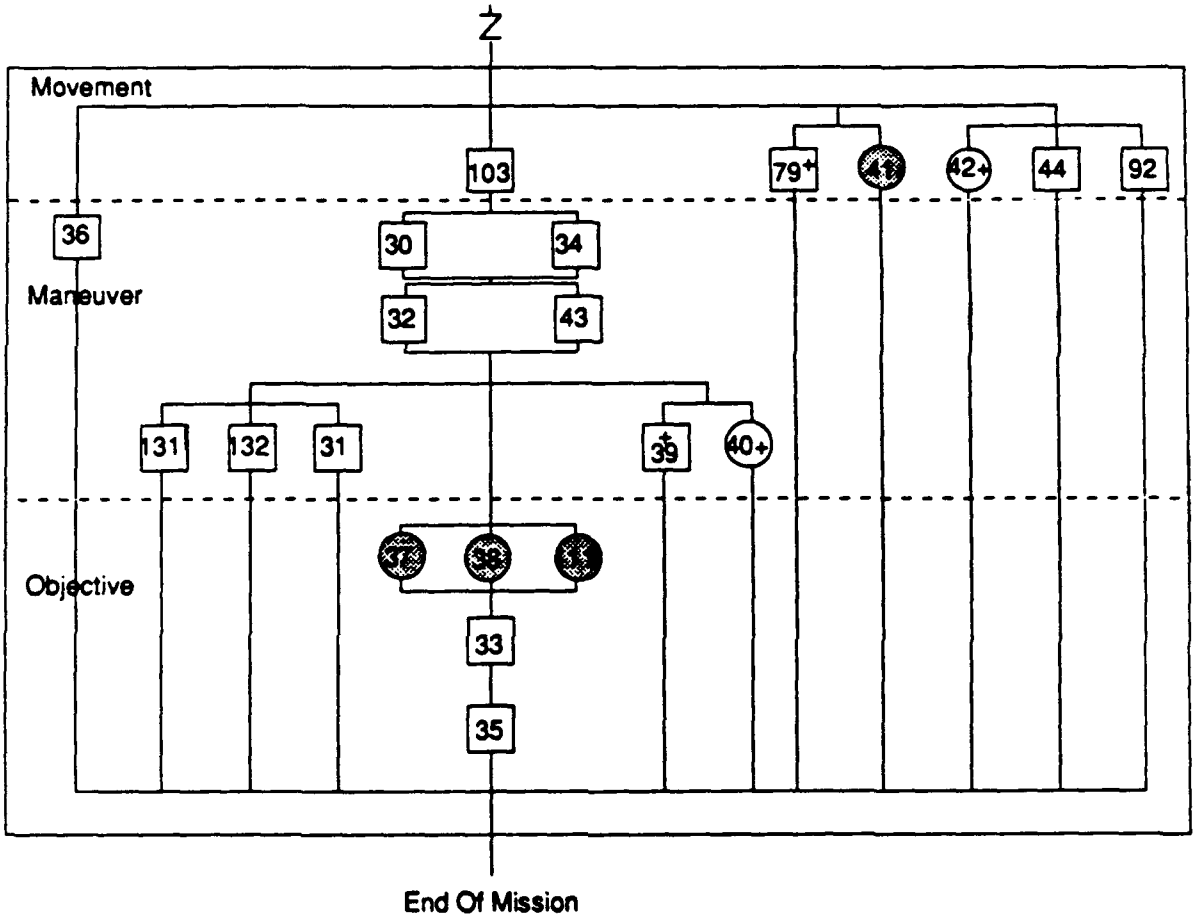


Figure 4. Battle flow framework.

EXECUTION PHASE SEQUENCING
PLATOON HASTY ATTACK



MISSION TASKS

30	React to Unexpected Enemy Contact
31	React to Change in Situation
32	Conduct Fire and Movement
33	Conduct Assault
34	Acquire and Engage Targets
35	Conduct Consolidation
36	Execute Fire Support Plan
37	Support Breaching Effort
38	Conduct Breach of Obstacle
39	Reorganize Assets
40	Conduct Evacuation Procedures
41	Respond to NBC Operations
42	Maintain Communications
43	Control Fires
44	Maintain Lateral Contact with Adjacent Units
79	React to Enemy Air
92	Control Movement
103	Move to Assault Position
111	Mark Breach
131	Issue FRAGO
132	Comply with Commander's Intent

Figure 5. Task linkage structure for execution phase of platoon hasty attack.

The third type of measurement specified by the measurement model in Figure 2 is expert judgment. The primary need for expert judgment is to gain creative insights on battle performance that may be missed by mechanically scored outcomes and task performance. Expert judgment on five types of dimensions have been identified as useful indicators in assessing unit capabilities: 1) accomplishment of mission segment/phase outcomes; 2) effectiveness of battlefield operating systems; 3) capability on key performance categories (such as move, shoot, communicate); 4) overall mission effectiveness rating; and 5) representativeness of mission (or identification of unusual circumstances).

In sum, the measurement model posits three forms of measurement for assessing unit performance: task performance, mission outcomes, and expert ratings of performance. Depending on the purpose for which data are being used (for example, diagnostic feedback or systemic analysis), these measures may be used as independent performance criteria or combined to form composite measures or a criterion index. However, a variety of cautions must be considered when using such measures collected in a field environment (see Hiller, 1987 for a thorough discussion of these issues).

Methodology for SIMNET Application

In developing a concept for a common performance measurement system, it is important to recognize that while the NTC and SIMNET share many commonalities they also have many unique features from a performance assessment perspective. Thus, our general approach has been to examine the applicability of the NTC-based model to SIMNET, to identify the boundaries of overlap in the two settings, and to examine the unique measurement capabilities of SIMNET for each component of the measurement model. Figure 6 presents an example of the boundaries between NTC and SIMNET capabilities and the unique aspects of each training setting.

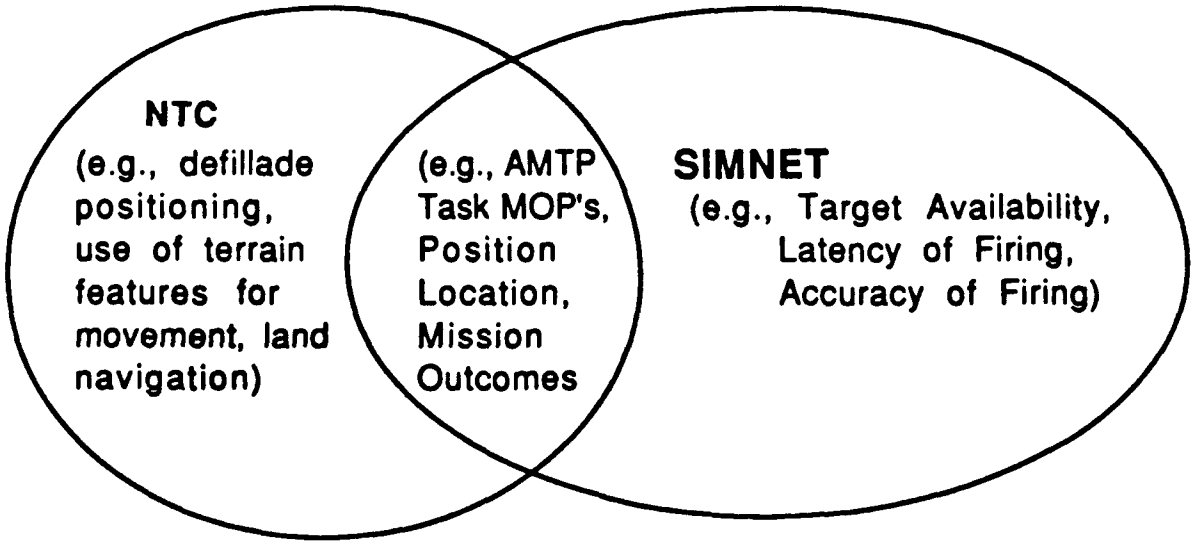


Figure 6. General performance measurement approach.

As noted at the outset of this report, the research scope for this effort was determined based on guidance from ARI and CATA at the project's June In-Progress Review (IPR) about frequency and type of training missions anticipated in initial SIMNET usage for unit training. The scope for the work described in this report includes two missions: platoon defense and platoon hasty attack. After the scope of the effort was identified, the next step was to determine the relevance of the critical tasks identified in the previous ARI research focused on the NTC to SIMNET. Each critical task was categorized as: 1) performed in the SIMNET device; 2) performed in the SIMNET complex; 3) supported in the SIMNET complex with modifications or additions; or 4) not supported. The results of this analysis are presented in the following section of this report.

For all critical tasks identified as potentially supportable in the SIMNET device or complex, measures of performance (MOPs) based on the previous ARI research were examined. This analysis suggested that most of the previously identified MOPs could be strengthened by further operationalization. Therefore, the decision was made to use the performance standards specified in the previous research as the starting point for generating MOPs.

Three types of MOPs have been generated based on the specific requirements of the critical task. Automated MOPs are those which can be gathered from the SIMNET data stream. We have given priority to these measures in an effort to increase reliability and to reduce the data collection burden on observers. Observable MOPs are those which can be gathered by direct observation of task performance, indirect observation using the planview display, or expert judgment based on a synthesis of the automated and observable MOPs. Other/additional MOPs are those which would require either a change in the SIMNET facility (such as the acquisition of a multi-channel recorder for radio nets) or a modification to simulation software. There are a number of important issues and tradeoffs which emerged from this activity which are discussed in the following section of this report.

All MOPs were subjected to internal review for their technical and substantive soundness and revisions made where necessary. While this report as the documentation of the measurement concept, there are several research steps which must be undertaken to translate this measurement concept into a fully functional feedback system for unit performance. These requirements are summarized in the concluding section of this report.

Key Findings

A number of important findings and critical issues emerged in the process of developing a common performance measurement concept for NTC and SIMNET. These are summarized below with the discussion organized by the three major forms of measurement inherent in the measurement model: mission outcomes, task performance, and expert judgment.

Mission Outcomes

As noted earlier in this report, the mission outcome indices derived for NTC missions included three measures: enemy attrition, friendly attrition, and terrain control. In considering the applicability of these measures to SIMNET, it is important to take into account that missions conducted at the NTC are generally battalion task force missions. Battalions are inherently capable of operating as independent units (i.e., separate from Brigade) because of their size and resources. Thus, terrain control (as well as destruction of the enemy and preservation of the friendly force) are legitimate purposes of a battalion task force mission. Therefore, the three measures above represent appropriate measures of mission effectiveness at the battalion task force level.

However, the focus of the present analysis is on two platoon missions: defense and hasty attack. Thus, the question of the applicability of these measures not only to the SIMNET environment, but also to platoon level missions generally, must be addressed. It should be noted that extension of this methodology to other Platoon missions would require a specification of the doctrinal purpose of those missions. It is the purpose of the mission that dictates the appropriate outcome indices to be used to measure mission performance. In the case of the selected two missions, this includes the three indices described above. For other missions, e.g., road march, these indices might be replaced with other more appropriate indices.

In addressing this question, it is important to note that platoons (whether at NTC or within SIMNET) always operate within the context of the larger company and battalion mission. This reality has two important implications for measuring the effectiveness of platoon missions. First, battalions are the smallest unit given terrain control responsibility on the battlefield. Platoons (and companies) do not have the resources to control terrain; thus, platoons use fire and maneuver to support the mission of higher echelons. Therefore, only measures related to enemy attrition (lethality) and friendly forces (survivability) are appropriate indices of mission effectiveness for platoons. These measures are easily gathered from the automated data stream supporting SIMNET.

Second, platoons are often assigned different roles in the support of the mission of higher echelons, particularly in the attack. For example, typically platoons are assigned one of four roles in a battalion attack: a breaching force, a security force, an assault element, or an attack by fire element. The breaching element has the responsibility to neutralize enemy obstacles and to provide security to the breaching force; the assault element is assigned to move on the objective while the attack by fire element suppresses enemy fire. The implication here is that measures of enemy and friendly attrition must be interpreted relative to the role of the platoon. Thus, standards for effective levels of "lethality" or "survivability" must be established with respect to the role of the platoon.

Figure 7 presents standards for interpreting the effectiveness of platoons in the defense. These standards were derived based on inputs from subject matter experts including observer/controllers at the NTC and doctrine writers at the Armor School. (See Lewman, Root, Zimmerman, and Baldwin, in preparation, for a fuller discussion of the methodology for deriving platoon mission standards.) These platoon mission standards for the defense are equally applicable in the NTC and SIMNET environments. In fact, as SIMNET data become available, normative distributions of performance on lethality and survivability indices can be derived as further input into the standard setting process.

Mission Purpose: Destroy Enemy Force	
Mission Performance Standards	
Enemy Forces (Lethality)	Destroy 70% of OPFOR in Sector
Friendly Forces (Survivability)	Retain 2 Combat Systems

Figure 7. Mission effectiveness standards for platoon defense.

As shown in Figure 8 below, the platoon attack mission is somewhat more complex. Platoons may be assigned one of four responsibilities as identified at the top of the figure. Standards for lethality and survivability derived from subject matter experts (Lewman et al., in preparation) take into account the responsibility of the platoon in the attack. The most problematic area for standard setting emerging from this research involves the suppression of enemy firing activity. The question of enemy firing levels and/or patterns that constitute effective suppression is

Mission Purpose	**Breach Enemy Obstacles** **Provide Security** **Assault the Objective** **Suppress Enemy Fire**
Mission Performance Standards	

Breaching Element*

-- Breach Force

Enemy Forces (Lethality)	Neutralize Obstacle No Fratricides Due to Obstacle
Friendly Forces (Survivability)	Retain 60% of Force

-- Security / Suppression Force

Enemy Forces (Lethality)	No Losses to Breach Force as a Result of OPFOR Direct Fire
Friendly Forces (Survivability)	Retain 2 Combat Systems

Assault Element

Enemy Forces (Lethality)	Suppressed Firing Activity (TBD)
Friendly Forces (Survivability)	Retain 2 Combat Systems

Attack by Fire (Suppression)

Enemy Forces (Lethality)	Suppressed Firing Activity (TBD)
Friendly Forces (Survivability)	Retain 2 Combat Systems

* Not currently supported in SIMNET

Figure 8. Mission effectiveness standards for platoon hasty attack.

very complex and is currently under further investigation in ARI sponsored research. Indeed, SIMNET provides a controlled environment for examining such issues and data from SIMNET battles may provide important insights into such questions as data become available. More generally, while the standards for the assault and attack by fire elements are applicable in the SIMNET environment, obstacle breaching is not presently supported.

Several cautions must be raised about the interpretation and use of mission effectiveness indices such as friendly attrition and enemy attrition. The first concerns the application of standards generally to mission performance criteria. While it is common practice in Army training to establish standards as cutoff criteria for judging task performance, the concept of standards applied to mission effectiveness is a potentially hazardous undertaking. First, it must be understood that there are no currently accepted standards within the Army community for mission effectiveness indices such as lethality and survivability. The standards laid out in Figures 7 and 8 were derived from inputs of subject matter experts (SMEs). These SMEs were primarily Observer/Controllers at the NTC who have witnessed large numbers of battles and who used their experience to develop standards on the mission effectiveness indices which in their experience reflected a breakpoint for judging combat effective versus ineffective platoons. However, there is considerable difference of opinion in Army circles about these types of standards and further research is needed.

A second caution concerns the role that conditions play in mission performance. Battlefield conditions, particularly the specific terrain on which missions are executed, and the force levels of the opposing sides, are likely to influence the difficulty of the mission, and place boundary limits on effectiveness. At present, these influences are not well understood and research is ongoing to examine the influence of conditions (especially terrain) on mission complexity and ultimately mission accomplishment. Thus, care must be exercised in interpreting measures of mission effectiveness under differing sets of conditions.

Finally and perhaps most importantly, the use to which mission outcome assessments are put must be carefully examined. Such measures, either treated as separate indices or combined into a summary index, provide a gauge for the validity of tactical doctrine. Examining the effectiveness of missions executed in accordance with tactical doctrine on repeated occasions provides a tool for demonstrating the value of current doctrine and for identifying areas of weakness. Furthermore, by examining the effectiveness of missions executed in innovative or non-doctrinal ways, lessons learned on doctrinal improvements can be derived. Such uses of outcome data in the aggregate (with protection of unit identification and proper database security) appear to be well accepted within the Army community. However, the use of outcome assessments as part of the diagnostic feedback process to units is somewhat more sensitive. Most Army trainers would agree that survivability and lethality indices provide a useful context for examining unit performance and identifying training strengths and weaknesses. However, this agreement disintegrates when such indices are intended to be used to "grade" units and to compare units against each other. Such cross-unit comparisons are fraught with problems given current limitations in our understandings of battlefield dynamics and the influence of varying conditions.

Critical Task Performance

A second major component of the measurement model centers on unit performance of mission critical tasks. Two important aspects of our analysis of critical task performance within the context of NTC and SIMNET missions merit discussion. The first focuses on the applicability of critical tasks in the two settings, the second on the development of measures of performance (MOPs) for common critical tasks. Key findings and issues that must be addressed are discussed below for each of these areas.

Applicability of Critical Tasks

Prior to analyzing the applicability of NTC-derived tasks to SIMNET, we examined the overlap on NTC-derived tasks across missions. The purpose of this preliminary analysis was to determine the impact of the initial research scope of the range of critical tasks to be considered. The results of this overlap analysis at the platoon level can be found in Figures 1 through 3 and Table A-1 of Appendix A. To summarize these results, selection of the two Platoon missions includes 37 of the 51 (72.5%) planning critical tasks, 23 of the 28 (82.1%) of the preparation critical tasks, and 30 of the 36 (83.3%) execution critical tasks in at least one of the missions.

The results of this analysis confirmed our expectation that the selection of the defend and hasty attack missions as a starting point would provide a broad platform of critical tasks from which to work. In all three phases, less than 20% of the platoon tasks for that phase must be performed in both defense and hasty attack. Thus, these two missions provide a diverse set of platoon tasks for analysis.

The results of our analysis of the applicability of mission critical tasks derived at the NTC to SIMNET are summarized in Figure 9 for the Platoon Defend mission and in Figure 10 for the Platoon Hasty Attack mission. Squares represent tasks that are currently supported in the SIMNET device (unshaded) or in the SIMNET complex (shaded). Circles represent tasks that either could be supported with modifications or additions to the SIMNET complex [such as by reconfiguration of space or acquisition of new equipment] (unshaded) or are not presently supported (shaded).

Several key findings emerged from these analyses. First, a large number of NTC critical tasks can be trained on SIMNET. More specifically, most planning and many preparation tasks can be performed in the SIMNET complex. Furthermore, the majority of execution tasks can be performed in the SIMNET device. Table 1 provides the number and percent of critical tasks by phase for the two missions that are supportable: in the SIMNET device; in the SIMNET complex; in the SIMNET complex with modifications; or not supported. These results show that a very high percentage of the tasks are supported by SIMNET across phases and missions.

MISSION: PLATOON DEFEND

	SIMNET DEVICE	SIMNET COMPLEX	COMPLEX WITH MOD.	NOT SUPPORTED
PLAN (N=24)	1 (4.2)	22 (91.6)	1 (4.2)	0 (0.0)
PREPARE (N=19)	2 (10.5)	7 (36.8)	5 (26.3)	5 (26.3
EXECUTE (N=18)	15 (83.3)	0 (0.0)	1 (5.5)	2 (11.1)

MISSION: HASTY ATTACK

	SIMNET DEVICE	SIMNET COMPLEX	COMPLEX WITH MOD.	NOT SUPPORTED
PLAN (N=22)	0 (0.0)	22 (100)	0 (0.0)	0 (0.0)
PREPARE (N=13)	1 (7.7)	8 (61.5)	3 (23.1)	1 (7.7)
EXECUTE (N=21)	16 (83.3)	0 (0.0)	1 (4.7)	4 (19.1)

NOTE: The 5 common tasks in each mission are supportable in the SIMNET complex during Planning and Preparation, and in the SIMNET device during Execution. Numbers in parentheses are percentage of critical tasks for the phase.

Table 1. Applicability analysis for platoon missions.

DEFEND - MISSION TASKS

9	Plan Reorganization
13	Plan for NBC Operations
14	Understand Commander's Intent
18	Plan Redundant Communications
23	Disseminate Fire Support Plan
25	Conduct Pre-Combat Checks
26	Prepare for NBC Operations
27	Establish Redundant Communications
36	Execute Fire Support Plan
41	Respond to NBC Operations
42	Maintain Communications
43	Control Fires
45	Conduct Leader's Reconnaissance
46	Conduct Terrain Analysis
47	Assign Sectors of Fire
48	Establish Disengagement Criteria
49	Develop Counterattack Plan
50	Plan Scheme of Maneuver
51	Dispatch Quartering Party
52	Verify Supporting Indirect Fires
53	Cover Obstacles with Observation and Fire
54	Plan Air Defense Measures
55	Develop Protective Obstacle Plan
56	Plan Evacuation Procedures
57	Develop Tentative Plan
58	Coordinate Planning with Adjacent Units
59	Prepare Platoon Sector Sketch
60	Plan Fire Control Measures
61	Prioritize Work Effort
62	Issue Operations Order
63	Position Weapon Systems
64	Integrate Fire Plans
65	Prepare Fighting Positions
66	Rehearse Battle Drills and Plans
67	Prepare for Limited Visibility Operations
68	Rehearse Reactions to Enemy Air
69	Disseminate Obstacle Plan
70	Reinforce Terrain
71	Record Minefields
72	Establish Emergency Resupply
73	Establish Contact with Adjacent Units
74	Supervise the Implementation of Plans and Orders
75	React to Indirect Fire
76	Execute Battle Handover
77	Execute Direct Fire Plan
78	Maneuver Platoon Elements
79	React to Enemy Air
80	Execute Obstacle Plan
81	Conduct Emergency Resupply
82	Control Movement
83	Maintain Contact with Adjacent Units
108	Maintain Operations Security
114	Disseminate Intelligence and Combat Information
115	Report Combat Information
116	Update Estimate of the Situation
123	Report On-Hand Status
126	Issue Warning Order
127	Conduct Mission Analysis
128	Initiate Planning Process
129	Conduct Briefbacks
130	Refine Plan
131	Issue FRAGO
132	Comply with Commander's Intent
133	Reorganize Assets
134	Acquire and Engage Targets
136	Conduct Evacuation Procedures

Figure 9. Mission Task List for Platoon Defend.

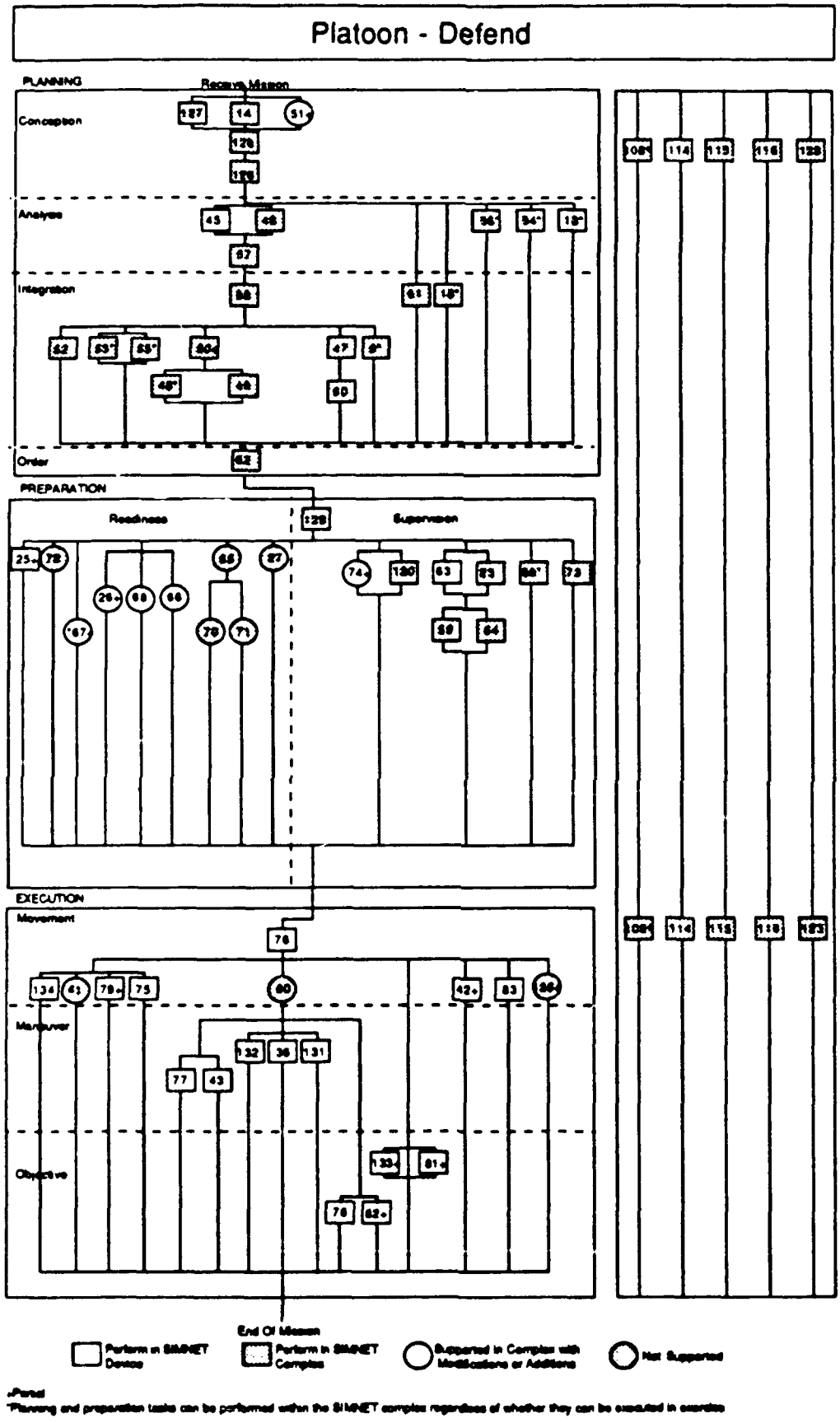


Figure 9a. Applicability of Critical Task Linkage Structure for Platoon Defend.

HASTY ATTACK - MISSION TASKS

2	Conduct Terrain Analysis
3	Identify Enemy Strengths and Weaknesses
4	Plan for Mutual Support
5	Plan Movement
6	Plan Actions on Contact
9	Plan Reorganization
11	Plan Air Defense Measures
13	Plan for NBC Operations
14	Understand Commander's Intent
15	Understand Control Measures
18	Plan Redundant Communications
19	Plan Fire Control and Distribution Measures
21	Conduct Battlefield Update
23	Disseminate Fire Support Plan
25	Conduct Pre-Combat Checks
26	Prepare for NBC Operations
27	Establish Redundant Communications
30	React to Unexpected Enemy Contact
31	*React to Change in Situation*
32	Conduct Fire and Movement
33	Conduct Assault
34	Acquire and Engage Targets
35	Conduct Consolidation
36	Execute Fire Support Plan
37	Support Breaching Effort
38	Conduct Breach of Obstacle
39	Reorganize Assets
40	Conduct Evacuation Procedures
41	Respond to NBC Operations
42	Maintain Communications
43	Control Fires
44	Maintain Lateral Contact with Adjacent Units
56	Plan Evacuation Procedures
68	Rehearse Reactions to Enemy Air
79	React to Enemy Air
92	Control Movement
93	Coordinate Plans with Lateral Units
94	Maintain Communications
95	Designate a Support by Fire Element
96	Designate Consolidation Procedures
97	Verify Supporting Fires
98	Establish Lateral Contact with Adjacent Units
99	Supervise the Implementation of Plans and Orders
100	Designate Battle Drills and Procedures
101	Establish Fire Support Communications
102	Prepare for Breaching Operations
103	Move to Assault Position
107	Maintain Operations Security
111	*Mark Breach*
114	Disseminate Intelligence and Combat Information
115	Report Combat Information
116	Update Estimate of the Situation
123	Report On-Hand Status
126	Issue Warning Order
127	Conduct Mission Analysis
128	Initiate Planning Process
129	Conduct Briefbacks
130	Refine Plan
131	Issue FRAGO
132	Comply with Commander's Intent

Figure 10. Mission Task List for Platoon Hasty Attack.

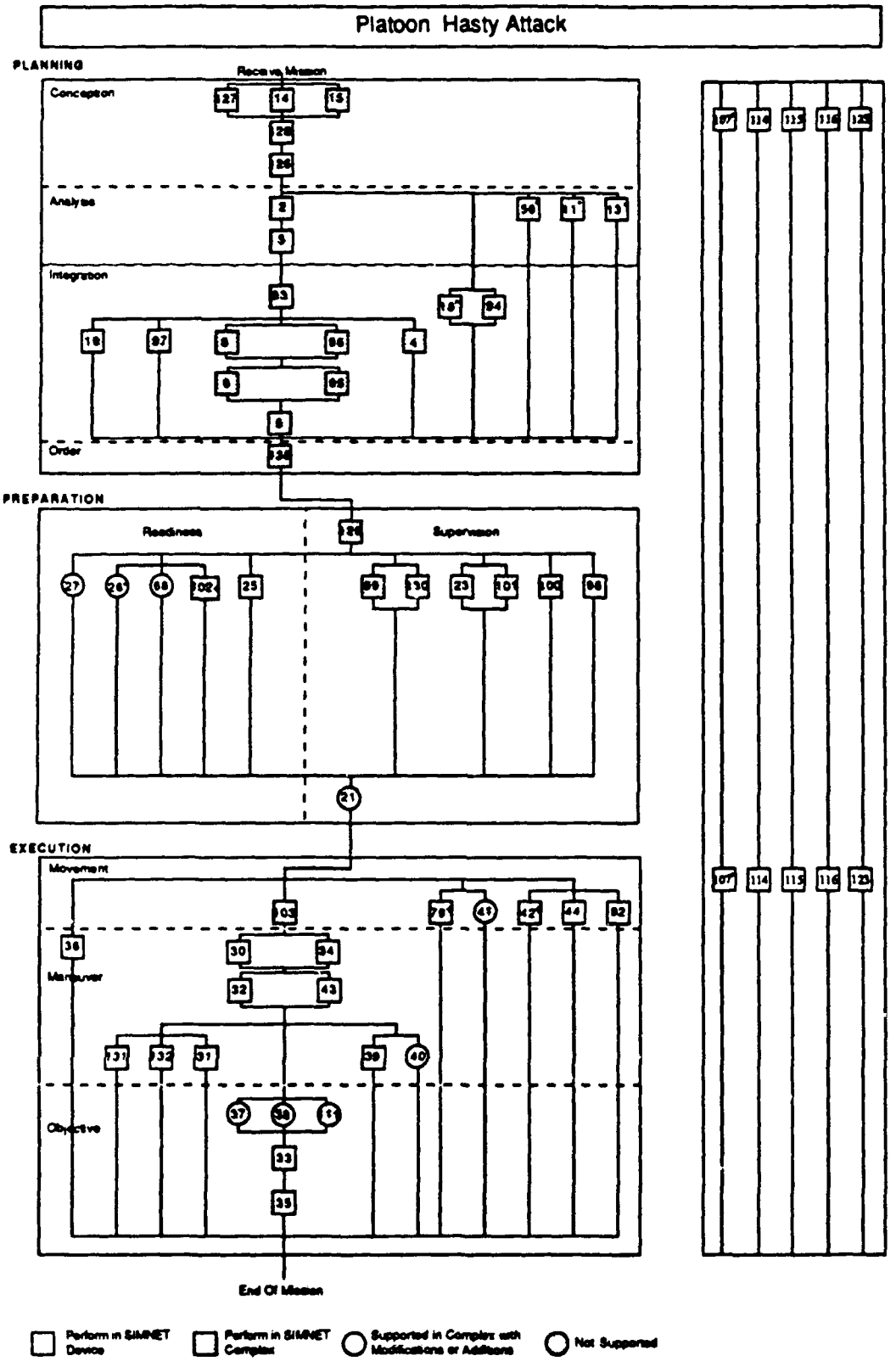


Figure 10a. Applicability of Critical Task Linkage Structure for Platoon Hasty Attack.

However, there are some significant limitations in task performance. First, our analysis indicated that some tasks can only be partially trained generally because some subtasks are not supported in the SIMNET environment. For example, Task 108 [Maintain Operations Security] for Platoon Defense has four subtasks: 1) maintain signal security; 2) maintain information security; 3) conduct counterintelligence measures; and 4) maintain physical security. Only the first subtask can be fully trained within the SIMNET environment using tactical radio/telephone communication between simulators or areas of the SIMNET complex. In contrast, the second subtask cannot be trained at all because it requires use of physical terrain and equipment that are currently unavailable. Further, only aspects of the third and fourth subtasks can be practiced in the SIMNET environment.

Second, some tasks can be planned or prepared for in the SIMNET complex (if desired); however, they cannot be executed in the SIMNET device at present. These tasks primarily involve NBC (nuclear, biological, chemical) operations, obstacle emplacement and breaching, casualty evacuation and the use of dismounted infantry.

Third, the training value for some tasks is limited by the capability of the simulation to replicate terrain usage. These limitations are particularly evident in the defense where vehicle usage of cover and concealment and defilade positions are partially supported, but the difficulty of the task and the interaction with the terrain is not consistent with performance of the same task in the field.

Some of the current limitations in training tasks on SIMNET will be overcome when the production version of SIMNET (CCTT) is fielded. Others could be addressed through additions to the SIMNET complex or software modifications. Others may be best dealt with through the development of an explicit training strategy which identifies the role of SIMNET training in conjunction with other unit training. The point here is that a training strategy should provide an integrated approach for ensuring that units have the opportunity to train on the full range of mission critical tasks, not that any one training approach such as SIMNET should necessarily train fully on all tasks. The Device-Based Field-Supported training strategy articulated by Beecher (1988) is one example of such an integrated training approach.

One final point about the perspective adopted in this applicability analysis deserves mention. We have examined the applicability of training NTC-derived critical tasks in SIMNET with a view of SIMNET as primarily a tactical maneuver/command and control trainer. Experience at the NTC has shown that tasks critical to mission success are collective (primarily maneuver) and leadership (mainly command and control) tasks. Thus, the NTC-derived tasks tend to be higher order group tasks or cognitively oriented leader tasks. We have examined the capability of SIMNET to exercise the performance of these tasks, not necessarily the capability of SIMNET to replicate the performance of these tasks exactly. From our perspective, selective fidelity represents a continuum with more or less fidelity required depending on the nature of the skills to be trained and the place of the training device in the overall unit training program. In contrast, Drucker, Campshure, and Campbell (1988) conducted a similar analysis of SIMNET's capabilities to provide a simulated environment for crew operations and individual crew member jobs. This analysis had a more concrete focus on individual skills and the operational mechanics of performing specific jobs and identified many shortcomings of SIMNET in allowing performance or practice of these types of tasks. These shortcomings primarily revolved around selective fidelity issues. We do not regard their findings as contradictory to ours; rather we see the differences as emerging from varying perspectives and perhaps different assumptions about the role of SIMNET within the context of a larger unit training program.

Development of Measures of Performance (MOPs)

The second major component of our analysis of critical task performance centered on the development of measures of performance (MOPs) for common critical tasks. As noted earlier, these MOPs were derived from the performance standards for tasks and subtasks that survived the applicability analysis. The measurement concept for three platoon missions can be found in Kerins and Atwood (in preparation a, b, and c) and for the corresponding company missions in Kerins, Root and Atwood (1989a, 1989b, and 1989c).

The measurement concept documented in each of these reports is ordered by battle phase (i.e., plan, prepare, execute) and by segment within phase (e.g., conception segment of the planning phase). For each common critical task, the task and any component subtasks are identified along with the doctrinal standard and reference. On the companion page, performance standards for the task or component subtasks are presented in conjunction with MOPs.

A number of clarifying points about the MOPs presented in these documents warrant discussion. First, MOPs specify variables which serve as indices of performance. That is, they provide specifications of the performance dimensions which can be used to assess whether a unit has met the performance standard. As such, MOP specification is part of the design phase of a unit performance measurement system. In order to build a fully functional feedback system, these MOPs must be translated into collection tools and strategies developed for analysis, interpretation and presentation. Aspects of these activities are part of other subtasks in this research effort and are discussed further in the concluding section of this report.

Three types of MOPs have been specified here. Automated MOPs are variables which can be extracted from the automated data stream driving the simulation and incorporated into an automated database. Observable MOPs are performance dimensions which may be observed or assessed by a human observer (e.g., dedicated Observer/Controllers or designated unit personnel). Other/additional MOPs are those which could be gathered through a change to the SIMNET facility (such as the acquisition of equipment) or through a modification to the SIMNET software.

There are a number of issues that must be recognized in examining the automated and observable MOPs and tradeoffs that must be weighed. First, we have given priority to the specification of automated MOPs in accordance with guidance from ARI and our understandings of current plans for fielding and staffing SIMNET at home stations. In some cases, these automated indices provide a direct and unambiguous measure of performance of a task or subtask; however, in other cases they require combination and interpretation.

For example, Task 76 from the execution phase of the Platoon Defend mission is to "Execute battle handover". There are three performance standards associated with this task. The first is "there are no friendly casualties as a result of friendly fires". In this case, the automated MOP is straightforward: the number of fratricides (friendly vehicles killed or hit by the defending unit). In contrast, the second performance standard is "platoon maintains continuous effective fires on advancing enemy elements". There a number of automated MOPs that bear on this performance standard including the number and type of rounds fired, the number and location of enemy vehicles hit or killed and the number and type of indirect fire missions. However, these are indirect indicators which must be combined and interpreted by a subject matter expert to arrive at a judgment about whether (or the degree to which) platoon fires were continuous and effective under those battle conditions.

Furthermore, the automated MOPs are limited in number and substantive focus (generally to movement, position location, and firing activity) because of the nature of the data stream supporting SIMNET. Many of these automated measures can serve as indirect indicators of the performance of the majority of execution tasks. From a measurement perspective, this overlap leads to nonindependence of measures and considerable covariation of performance indicators

across tasks. While this problem is somewhat attenuated by the fact that indicators are likely to be combined and interpreted in somewhat different ways given the nature of the task to which they are applied, the issue requires consideration of technical implications as well as other measurement alternatives beyond the automated data stream.

Second, the observable MOPs bring other issues to bear. Measures of performance of many tasks, especially those in the planning and preparation phases, can be physically observed in the SIMNET complex. In some cases, these indicators are fairly direct and straightforward measures which could be gathered fairly reliably by an observer with some training. However, in other cases, the indicators must be inferred from behavior because the task involves mental/cognitive activity.

For example, Task 127 in the planning phase of the Platoon Defense mission is to "Conduct mission analysis". This task is largely a cognitive analytic activity that must be accomplished by the platoon leader which is not directly observable. The performance standards for this task relate to complete identification of specified and implied tasks and accurate mission analysis on the factors of METT-T. Thus, the observer would need to watch for a variety of behavioral manifestations (such as study of the order from higher, discussions with staff or talking aloud) that would allow him to formulate a judgment on the completeness and accuracy of the mission analysis. In contrast, Task 128 in the planning phase is to "Initiate the planning process". This task primarily involves using the reverse planning process to allocate time, assigning specific responsibilities to platoon members, and issuing preliminary graphics. These indicators can be directly observed and assessed using tangible evidence by an observer in a much more straightforward way. Clearly, the training demands on observers to make these two types of judgments reliably vary greatly.

Further, performance of some tasks cannot be observed directly (because of the closed box simulator) but must be inferred based on indirect indicators. For example, while an observer cannot view tank crews directly, he can observe their location and activity on the battlefield using the planview display. In addition, by monitoring the communications nets, an observer can gather additional information on which to base inferences about task performance.

In sum, there are number of tradeoffs that must be considered in determining MOPs that will be translated into collection tools. Automated MOPs have the advantage of easy collection but often require combination and interpretation in order to use them as measures of task performance. In addition, they are constrained in number and scope leading to problems of overlap and nonindependence. Observable MOPs are a prerequisite for assessing many types of tasks, especially in the planning and preparation phases. However, they bring demands for personnel (human observers) who must be trained to make reliable judgments. These training demands vary greatly depending on the amount of inference and interpretation required. Furthermore, MOPs could be considerably strengthened through the acquisition of new equipment in the SIMNET complex (especially a multi-channel recorder for communications nets) and through modifications to SIMNET software. However, these additions and modifications also carry resource implications. Thus, resource allocation decisions must be traded off in light of the technical benefits to be gained. We have purposely laid out the alternatives here; it is the prerogative of the government to make such resourcing and policy decisions.

Expert Judgment

The third major component of the measurement model is expert judgment. As noted earlier, the primary need for expert judgment is to gain creative insights on battle performance that may be missed by mechanically scored outcomes and task performance.

Our analysis suggests that expert judgment on all five types of dimensions identified as useful indicators at the NTC can serve a comparable function within SIMNET. These dimensions include: 1) accomplishment of mission segment/phase outcomes; 2) effectiveness of battlefield operating systems; 3) capability on key performance categories (such as shoot, move, and communicate); 4) overall mission effectiveness rating; and 5) representativeness of mission (or identification of unusual circumstances).

It is important that when these dimensions are translated into a collection guide for observers that a requirement be levied for observers to supply evidence to support extremely high or low numerical ratings. This evidence may take the form of an observation, an interview, a planview screen display, a clip of a communications net, or a unit produced document such as an Operations Order. Such ratings in combination with tangible evidence provide a global context for interpreting outcome or task-oriented measurements and for identifying unique sets of circumstances influencing a unit's performance. They also serve as potentially persuasive tools for use in an After Action Review or other diagnostic feedback setting.

Discussion

The concept presented in this report has several important implications for the effective use of SIMNET as part of the larger Army training system. First, the concept operationalizes the specific tasks and measures of performance within the confines of a three-part systems model. Further, this model has been applied to the National Training Center (NTC) to enhance the performance measurement and feedback at this advanced training facility. The application of the same model and attendant methodology helps to ensure comparability in performance measurement and feedback between the NTC and SIMNET.

As with the application of this measurement model and approach to the NTC, several benefits accrue to SIMNET. First, the structures inherent in the model provide an organizing structure for training feedback. In particular, the Battle Flow Framework and Task Linkage structures provide simple graphical tools for tracing performance and identifying major performance breakdowns. Thus, these structures can serve to guide the discussion of performance during an After Action Review (AAR) or to organize textual feedback for a Take Home Package (THP) or other paper-based report. Finally, these structures make it simple for a unit commander or other relevant personnel to quickly spot breakdowns, patterns of performance, and strengths and weaknesses that need to be addressed in subsequent training.

Beyond the enhanced value of feedback for the unit, the concept presented here offers the potential for systemic feedback as well. The approach embodied here is consistent with that employed by the Center for Army Lessons Learned programs. Thus, the training data captured through this measurement approach can provide a platform for generation of analyses addressing the areas of Doctrine, Training, Organization, Materiel, and Leadership (DTOML). Further, the data can be used in conjunction with comparable data from the NTC to broaden the scope and increase the richness of these analyses. Lastly, this system and the data captured by it provides a tremendous research resource for use by the Army's research agency, ARI.

An important issue associated with the concept presented here concerns the advisability and applicability of the end-of-mission standards. Recently, senior Army leadership has revisited the issue of applying set numerical standards to mission performance. Senior leaders determined that specific numbers could not be set for the many conditions under which the missions might be performed. Therefore, the current guidance is that it is the commander's responsibility to determine whether mission performance met the standard or not. The standards provided in this document are not viewed as contradictory to this guidance. Rather, they are provided as a benchmark derived from empirical analyses of performance at the National Training Center, modified by the expert judgment of the Observer/Controller cadre at the NTC. We are not

recommending the use of these standards by the units training in SIMNET nor their inclusion in the unit's AAR. Rather, we offer them as one source of data that might be considered in examining unit performance, or more appropriately, to be used by researchers who might need to derive higher order variables to summarize unit performance. It should also be noted that while "standards" were provided for only the Platoon Defense and Hasty Attack missions, that simple direct extensions of these would provide comparable baselines for other Platoon or Company missions. In sum, we felt that the provision of this information was a necessary component of a comprehensive measurement model and concept for SIMNET.

An ancillary benefit of the applicability analysis conducted on each of the mission critical tasks was the identification of modifications or additions to SIMNET or the SIMNET complex that would allow for performance of certain tasks. Generally, these additions or modifications involved minor software additions or acquisition of new equipment for use in the complex. The details of these changes have been provided in Appendix B of this report.

The measurement concept must now be elaborated through a systematic design process in order to build a fully functional feedback system. This process includes designing collection tools including screen displays for automated data and collection guides for observers. In addition, plans for data analysis, approaches for data interpretation, and strategies for presentation must also be formulated. These activities constitute next steps in the research process. Aspects of these steps are the focus of subsequent tasks and subtasks in this research effort.

Summary

This report has presented a concept for the design of a common performance measurement system for unit training at the National Training Center (NTC) and with Simulation Networking (SIMNET). The report uses two platoon missions, Defend and Hasty Attack, as the vehicle for presenting this measurement concept. The concept has been extended to Platoon Movement to Contact mission and to the Company level.

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APPENDIX A
OVERLAP ANALYSIS

Task Number	Task Description	Defend	Day Attack	Night Attack	Movement To Contact	Hasty Attack
107	Maintain Operations Security.		●	●	●	●
108	Maintain Operations Security.	●				
51	Dispatch Quartering Party.	●				
14	Understand Commander's Intent.	●	●	●	●	●
15	Understand Control Measures.		●	●	●	●
1	Conduct Leader's Reconnaissance.		●	●		
2	Conduct Terrain Analysis.		●	●	●	●
3	Identify Enemy Strengths and Weaknesses.		●	●	●	●
45	Conduct Leader's Reconnaissance.	●				
46	Conduct Terrain Analysis.	●				
11	Plan Air Defense Measures.		●	●	●	●
54	Plan Air Defense Measures.	●				
56	Plan Evacuation Procedures.	●	●	●	●	●
13	Plan for NBC operations.	●	●	●	●	●
57	Develop Tentative Plan	●				
4	Plan for Mutual Support.		●	●		●
5	Plan Movement.		●	●	●	●
6	Plan Actions on Contact.		●	●	●	●
7	Plan Assigned Actions at the Objective.		●	●		
8	Plan Consolidation		●			
9	Plan Reorganization.	●	●	●	●	●
47	Assign Sectors of Fire.	●				
48	Establish Disengagement Criteria.	●				
49	Develop Counterattack Plan.	●				
50	Plan Scheme of Maneuver.	●				
84	Develop Contingency Plans.				●	
95	Designate a Support by Fire Element.					●
96	Designate Consolidation Procedures.					●
106	Plan Consolidation.			●		
10	Analyze and Integrate Supporting Fire Plans.		●	●		
52	Verify Supporting Indirect Fires.	●				
53	Cover Obstacles with Observation and Fire.	●				
85	Analyze and Integrate Supporting Fire Plans.				●	
97	Verify Supporting Fires.					●
12	Develop Obstacle Breaching Plan.		●	●		
55	Develop Protective Obstacle Plan.	●				
86	Plan Breaching Operations.		●	●	●	
16	Coordinate Planning with Adjacent Elements.		●	●	●	
18	Plan Redundant Communications.	●	●	●	●	●
19	Plan Fire Control and Distribution Measures.		●		●	●
58	Coordinate Planning with Adjacent Units.	●				
60	Plan Fire Control Measures.	●				
61	Prioritize Work Effort.	●				
93	Coordinate Plans with Lateral Units.					●
94	Maintain Communications.					●
104	Plan Movement Control Measures.			●		
105	Plan Fire Control Measures.			●		
17	Graphically Illustrate Scheme of Maneuver		●	●	●	
20	Issue Operations Order.		●	●	●	
62	Issue Operations Order.	●				
	Issue FRAGO.					●

Figure A-1. Overlap of platoon planning tasks by mission

Task Number	Task Description	Defend	Day Attack	Night Attack	Movement To Contact	Hasty Attack
22	Conduct Rehearsals.		●	●	●	
65	Prepare Fighting Positions.	●				
66	Rehearse BattleDrills and Plans.	●				
67	Prepare for Limited Visibility Operations.	●				
68	Rehearse Reactions to Enemy Air.	●	●	●	●	●
24	Rehearse Breaching Operations.		●	●	●	
70	Reinforce Terrain.	●				
71	Record Minefields.	●				
102	Prepare for Breaching Operations.					●
25	Conduct Pre-Combat Checks.	●	●	●	●	●
72	Establish Emergency Resupply.	●				
26	Prepare for NBC Operations.	●	●	●	●	●
27	Establish Redundant Communications.	●	●	●	●	●
21	Conduct Battlefield Update.		●	●	●	●
87	Determine Enemy Strengths and Weaknesses.				●	
63	Position Weapon Systems.	●				
64	Integrate Fire Plans.	●				
100	Designate Battle Drills and Procedures.					●
23	Disseminate Fire Support Plan.	●	●	●	●	●
101	Establish Fire Support Communications.					●
69	Disseminate Obstacle Plan.	●				
28	Establish Contact with Adjacent Units.		●	●	●	
29	Supervise the Implementation of Plans and Orders.		●	●	●	
59	Prepare Platoon Sector Sketch	●				
73	Establish Contact with Adjacent Units.	●				
74	Supervise the Implementation of Plans and Orders.	●				
98	Establish Lateral Contact With Adjacent Units.					●
99	Supervise the Implementation of Plans and Orders.					●

Figure A-2. Overlap of platoon preparation tasks by mission

Task Number	Task Description	Defend	Day Attack	Night Attack	Movement To Contact	Hasty Attack
75	React to Indirect Fire.	●				
76	Execute Battle Handover.	●				
89	Conduct Movement.		●	●	●	
103	Move to Assault Position.					●
134	Acquire and Engage Targets.	●				
79	React to Enemy Air.	●	●	●	●	●
80	Execute Obstacle Plan.	●				
136	Conduct Evacuation Proceedures.	●				
41	Respond to NBC Operations.	●	●	●	●	●
42	Maintain Communications.	●	●	●	●	●
44	Maintain Lateral Contact with Adjacent Units.		●	●	●	●
83	Maintain Contact with Adjacent Units.	●				
92	Control Movement.		●	●	●	●
88	Identify Enemy's Strengths and Weaknesses.				●	
30	React to Unexpected Enemy Contact.		●	●		●
31	React to Change in Situation.		●	●	●	●
32	Conduct Fire and Movement.		●	●		●
34	Acquire and Engage Targets.		●	●	●	●
77	Execute Direct Fire Plan.	●				
90	Maintain Security.				●	
91	Conduct Actions on Contact.				●	
36	Execute Fire Support Plan.	●	●	●	●	●
135	Conduct Breach of Obstacle.				●	
137	Mark Breach				●	
39	Reorganize Assets.		●	●	●	●
40	Conduct Evacuation Proceedures.		●	●	●	●
43	Control Fires.	●	●	●	●	●
33	Conduct Assault.		●	●		●
35	Conduct Consolidation.		●	●		●
78	Maneuver Platoon Elements.	●				
37	Support Breaching Effort.		●	●		●
38	Conduct Breach of Obstacle.		●	●		●
111	Mark Breach		●	●		●
81	Conduct Emergency Resupply.	●				
133	Reorganize Assets.	●				
82	Control Movement.	●				

Figure A-3. Overlap of platoon execution tasks by mission

PLAN (TOTAL TASKS = 51)

	Defend	Day Attack	Night Attack	MTC	Hasty Attack
Defend	17+ (33.3)++	5 (9.8)	5 (9.8)	5 (9.8)	5 (9.8)
Day Attack		1 (2.0)	21 (41.2)	17 (33.3)	14 (27.5)
Night Attack			3 (5.9)	16 (31.4)	13 (25.5)
MTC				2 (3.9)	13 (25.5)
Hasty Attack					6 (11.8)

PREPARATION (TOTAL TASKS = 28)

	Defend	Day Attack	Night Attack	MTC	Hasty Attack
Defend	12 (42.9)	5 (17.9)	5 (17.9)	5 (17.9)	5 (17.9)
Day Attack		0 (0.0)	10 (35.7)	10 (35.7)	6 (21.4)
Night Attack			0 (0.0)	10 (35.7)	6 (21.4)
MTC				1 (35.7)	6 (21.4)
Hasty Attack					5 (35.7)

EXECUTION (TOTAL TASKS = 36)

	Defend	Day Attack	Night Attack	MTC	Hasty Attack
Defend	11 (30.6)	5 (13.9)	5 (13.9)	5 (13.9)	5 (13.9)
Day Attack		0 (0.0)	19 (52.8)	12 (33.3)	18 (50.0)
Night Attack			0 (0.0)	12 (33.3)	18 (50.0)
MTC				5 (13.9)	11 (30.6)
Hasty Attack					1 (2.8)

+Diagonal entries present number and percent of tasks unique to a particular mission.
++Numbers in parentheses are percent of critical tasks for phase.

Table A-1. Number and percent of critical tasks common to mission pairs by mission phase

APPENDIX B
RECOMMENDATIONS FOR ADDITIONS OR MODIFICATIONS

Supported in Complex With Additions or Modifications

Suggested or required changes to the SIMNET facility to improve the quality of training, the training experience, and the training feedback.

- Communications
  - Monitoring capability
  - Recording capability
    - Time tagging
    - Synchronized with actions on the simulator
  - Playback for AAR purposes
- Minor Software Fixes
  - Plan view display
    - Graphic control measures
    - Plans/operations (unit)
    - Fire plans
    - Sector sketches
    - Obstacle/barrier locations
- Unit Provided Materials
  - SOPs
  - Orders
  - Overlays